U.S. Department of Transportation

**Federal Aviation Administration**

# Advisory Circular

**Subject:** Change 1 to Design of Aircraft Deicing Facilities

**Date:** 8/13/99
**Initiated by:** AAS-100

**AC No:** 150/5300-14
**Change:** 1

**1. PURPOSE.** The change updates the definitions of aircraft deicing facilities and holdover times of fluids, design criteria for aircraft de/anti-icing fluid storage and transfer systems, information concerning recycling of glycols, and references.

The change number and date of changed text are located in the top header of the page. A vertical bar located on the left margin identifies revised text. Pages not revised by the change retain the former page header.

**2. PRINCIPAL CHANGES.**

**a.** Includes the reference SAE ARP 4902, *Design and Operation of Aircraft Deicing Facilities*, to provide operational guidance for facility users.

**b.** Expands the definition of aircraft deicing facilities to include the removal of and allow protection against the formation of slush.

**c.** Revises the definition of holdover time of fluids to agree with current industry practices.

**d.** Updates design criteria and reference for storage tank and fluid transfer systems.

**e.** Includes the reference AC 150/5320-15, *Management of Airport Industrial Waste*, to provide best management practices guidance to mitigate various types of potential pollutants from entering storm water runoff conveyances.

**f.** Updates information concerning the recycling of glycols.

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# CHAPTER 1. INTRODUCTION

**1. OVERVIEW**. Safe and efficient aircraft operations are of primary importance in the development of any aircraft deicing facility. This AC discusses sizing, siting, environmental runoff mitigation, and operational needs of a deicing facility in an effort to maximize its deicing capacity while maintaining maximum safety and efficiency. Airport managers can construct, within FAA standards, deicing facilities at terminals, on apron areas, taxiways, or near departure runways. The Society of Automotive Engineers (SAE) publication, Aerospace Recommended Practice (ARP) 4902, *Design and Operation of Aircraft Deicing Facilities*, current edition, provides a number of operational issues associated with off-gate deicing facilities. The operational issues should be addressed prior to the design of the facility to ensure that the safety benefits offered by the facility can be achieved in an operationally efficient and cost-effective manner.

**a. Role of Deicing Facility**. The design of deicing facilities should, to the extent practicable, meet the needs of air carriers as outlined in aircraft ground deicing/anti-icing programs as well as all other elements of the aviation community. A key element in this effort is designing a facility that is efficient and offers users operational flexibility. By coordinating an airport manager's Snow and Ice Control Plan and user's ground deicing/anti-icing programs with input from the FAA, icing conditions can be better met.

**b. Design Flexibility**. This AC identifies aircraft deicing facilities as being either centralized or remote (see subparagraphs 2(b) and 2(c)).

**(1) Centralized Deicing Facilities**. Centralized deicing facilities, where aircraft receive initial deicing/anti-icing treatment, can be constructed at numerous sites with increasing constraints towards departure runways. A terminal, for example, is a centralized deicing facility whose gates are the aircraft deicing pads used for deicing/anti-icing operations. Gate areas that cannot meet storm water permitting regulations but can adequately handle deicing/anti-icing demands of users and allow acceptable taxiing times to the departure runway under varying weather conditions, should, if practicable, be upgraded environmentally.

**(2) Remote Deicing Facilities**. Remote deicing facilities allow aircraft to receive initial and additional deicing/anti-icing treatment. Siting remote facilities near departure runways minimizes the taxiing time between treatment and takeoff. Such facilities also compensate for changing weather conditions when icing conditions or blowing snow are expected to occur along the taxi route taken by aircraft to the departure runway.

**2. DEFINITIONS.**

**a. Aircraft Deicing Facility**. An aircraft deicing facility is a facility where:

**(1)** frost, ice, slush, or snow is removed (deicing) from the aircraft in order to provide clean surfaces, and/or

**(2)** clean surfaces of the aircraft receive protection (anti-icing) against the formation of frost or ice and accumulation of snow or slush on clean surfaces of the aircraft for a limited period of time (holdover time).

**b. Centralized Deicing Facility**. A centralized deicing facility is an aircraft deicing facility located at the terminal gates/aprons or along taxiways serving departure runways.

**c. Remote Deicing Facility**. A remote deicing facility is an aircraft deicing facility located along taxiways serving departure runways or near the departure end of runways.

**d. Aircraft Deicing Pad**. An aircraft deicing pad consists of two areas (see figure 1-1):

**(1)** inner area for the parking of aircraft to receive deicing/anti-icing treatment, and

**(2)** outer area for maneuvering two or more mobile deicing vehicles.

**e. Holdover Time**. Holdover time is the ***estimated*** time the application of anti-icing fluid will prevent the formation of frozen contamination on the protected surfaces of an aircraft. With a one step deicing/anti-icing operation the holdover begins at the start of the operation and with a two step operation at the start of the final anti-icing application. Holdover time will have effectively run out when frozen deposits start to form/accumulate on the treated aircraft surfaces. For departure planning purposes, SAE publishes holdover time guidelines for various anti-icers, such as, Type I, IV. Guidelines can be found in SAE ARP 4737, *Aircraft Deicing/Anti-icing Methods with Fluids* current edition. The Association of European Airlines (AEA) notes: *"Due to the many variables that can influence holdover times, these times should not be considered minimum or maximum as the actual time of protection may be reduced or extended, depending upon particular conditions existing at the time."*

**3. PROJECT INPUT**. Because each airport is unique, deicing/anti-icing needs of users are better addressed when affected parties provide input in identifying the requirements for deicing facilities.

**a. Affected Parties**. Airport management should solicit input from the following parties:

**(1)** FAA Air Traffic Control, Airports, Airways Facilities, and Flight Standards Offices,

**(2)** airport operations chief, environmental manager, and the aircraft rescue and firefighting chief,

**(3)** station/operations managers of tenant air carrier and regional or commuter air carriers,

**(4)** pilot organization or representatives, air taxi, and general aviation users,

**(5)** ground deicing managers of air carrier, regional or commuter air carriers, and/or the FBO contracted with the responsibility,

**(6)** engineering contractor, and

**(7)** other parties at the discretion of airport management.

**b. Other**. It is recommended that the Federal, state, and local environmental authorities having jurisdiction be involved or kept informed at an early stage of facility development to ensure compliance with storm water permitting requirements. Review of deicing facility plans by environmental authorities is a significant step towards compliance with National Pollutant Discharge Elimination System (NPDES) storm water permitting requirements.

**4. RELATED READING MATERIAL**. Publications referenced within this AC are available by writing to:

**a. FAA Advisory Circulars**, U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

**b. Society of Automotive Engineers**, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

**c. The International Organization for Standardization**, Case Postal 56, Rue de Varembe, CH-1211 Geneva 20, Switzerland.

## CHAPTER 2. SIZING AND SITING DEICING FACILITIES

**4. GENERAL**. Aircraft deicing facilities are recommended at airports where icing conditions are expected. This includes airports that serve aircraft that can develop frost or ice on critical surfaces even though the airport itself does not experience ground icing conditions.

**a. Centralized Deicing Facilities at Terminals**. For some airports, centralized deicing facilities at or adjacent to terminals can adequately meet the deicing/anti-icing demands of users and still allow acceptable taxiing times to the departure runways under varying weather conditions. Improvements to or expansion of these facilities at terminal gates should, if practicable, include apron drainage areas that collect glycol runoff for proper disposal or recycling.

**b. Centralized Deicing Facilities off the Terminal**. Centralized deicing facilities off the terminal are recommended when terminal deicing facilities (including apron facilities) experience excessive gate delays, taxiing times, or suffer from severe weather conditions conducive to aircraft ground icing conditions. When the construction cost for runoff mitigation is not cost-effective, terminals whose deicing gates lack permanent environmental runoff structures are candidates for off-terminal deicing facilities. Centralized deicing facilities have the following components:

**(1)** an aircraft deicing pad(s) for the maneuvering of aircraft and mobile deicing vehicles,

**(2)** bypass taxiing capability,

**(3)** environmental runoff mitigation measure,

**(4)** permanent or portable nighttime lighting system, and, but not necessarily

**(5)** support facilities that may include one or more of the following:

**(i)** storage tank(s), transfer system(s) for aircraft deicing/anti-icing fluid(s),

**(ii)** deicing crew shelter, and

**(iii)** fixed fluid applicator.

**c. Remote Deicing Facilities**. Remote deicing facilities located near departure runway ends or along taxiways are recommended when taxiing times from terminals or other centralized deicing facilities frequently exceed holdover times. Under changing weather conditions, they can compensate for icing conditions or blowing snow expected to occur along the taxi route taken by aircraft to the departure runway. These facilities can improve flow control by permitting retreatment of aircraft without having the aircraft return to a more distant treatment site. Remote deicing facilities have the following components:

**(1)** an aircraft deicing pad(s) for the maneuvering of aircraft and mobile deicing vehicles,

**(2)** bypass taxiing capability,

**(3)** environmental runoff mitigation measure, and

**(4)** portable nighttime lighting system.

**5. FAA CLEARANCE AND SEPARATION STANDARDS AFFECTING DEICING FACILITIES**. To assure aircraft safety, the location and operation of deicing facilities need to be within the framework of FAA's clearance and separation standards in AC 150/5300-13, Airport Design. These standards involve air space, aircraft separations, FAA airway facilities critical areas, and Airport Traffic Control Tower (ATCT) line-of-sight criteria.

**a. Object Clearance Criteria**. Deicing facilities shall be sited in accordance with object clearing criteria described in paragraph 211, Object Clearing Criteria, in AC 150/5300-13. One alternative airports have for constructing deicing facilities with limited physical space is to site the facility in a non-movement area. Such siting reduces wing tip clearance criteria, thereby allowing closer aircraft separations, i.e., taxilane criteria versus taxiway criteria. In such cases, the airport operator should contact ATCT to redefine a portion of a movement area as non-movement.

**b. FAA Airway Facilities**. Deicing facilities shall be located so as not to cause signal interference or signal degradation to existing FAA radar, NAVAIDs, airport lighting, weather facilities, and communications. This includes interference or degradation caused by deicing facilities with fluid storage tanks, crew shelters, and permanent nighttime lighting structures. If any FAA airway facilities improvements are planned, sufficient obstacle clearances, as required by new airway facilities, must be protected. Some airports may have further requirements for the installation of additional FAA communications equipment because of the assignment of operating frequencies to meet the operating needs of the deicing facility. Additional communications equipment installations may result from increased ground control frequencies necessary for ATCT to provide safe flow of airport ground traffic and to enable ground deicing personnel to conduct safe deicing operations. In all cases, the installation of communications equipment and assignment of frequencies need to be coordinated with FAA Airway Facilities prior to the construction of deicing facilities. To further protect FAA airway facilities, sites should also be evaluated with respect to the impact of jet blast velocities and exhaust deposits on facilities.

**c. ATCT Line-of-Sight**. The deicing facility and its supporting structures shall minimize reductions to ATCT's visual contact with the movement area. To maintain ATCT's visual contact, aircraft being deiced/anti-iced should not cast shadows onto active runway ends and their entrance taxiways. To minimize shadows, aircraft with the largest surfaces to be treated are recommended for evaluation. Furthermore, visual contact of movement areas from planned ATCT cab positions should also be evaluated.

**6. CAPACITY OF DEICING FACILITIES**. Airports are recommended to have deicing facilities with a deicing/anti-icing capacity that approximates the airport's peak hour departure rate that ATCT can manage during icing conditions. This departure rate in turn estimates a number of aircraft deicing pads at a facility or facilities necessary to balance the departure rate and the holdover times of applied deicing/anti-icing fluids so that, to the extent practicable, holdover times are in effect when the pilot receives takeoff clearance. To meet the needs of future aircraft, an evaluation is recommended of aircraft development for a planning period of at least 10 years. This information is available from air carriers (anticipated airline service, aircraft on order) and airframe manufacturers.

**7. FACTORS AFFECTING NUMBER OF AIRCRAFT DEICING PADS AND DEICING FACILITIES**.

**a. Number of Deicing Pads**. Evaluating the impact of the following factors provides a better estimate of the number of deicing pads needed at a facility.

**(1) Procedures and Methods of Users**. Facility users will perform either one-step or two-step deicing/anti-icing procedures. The latter procedure, routinely used during periods of precipitation, results in longer occupancy times of deicing pads. To provide users with procedural flexibility, the number of deicing pads should be based on the two-step approach. Furthermore, increases to this occupancy time may be needed to reflect user differences in the methods used to treat their aircraft and perform preflight inspections. It is not unusual for users to supplement preflight inspection items recommended by aircraft manufacturers with additional items for aircraft having special operational considerations.

**(2) Variations in Meteorological Conditions**. Variations in meteorological conditions, e.g., type of precipitation, increases the extent (and frequency) of the deicing/anti-icing treatment. Airports that commonly experience heavy wet snows or freezing rain should accordingly increase the number of deicing pads to maintain departure flow rates at levels that avoid unacceptable delays for subsequent aircraft awaiting treatment. If revised flow control procedures to reduce taxiing times fail to prevent the impact of such meteorological conditions from frequently degrading the holdover time used for the initial treatment, a facility closer to the active runway is recommended. To the extent practicable, there should be a balance between the number of deicing facilities and their location to offset severe meteorological conditions so that holdover times are in effect at takeoff.

**(3) Type of Aircraft Receiving Treatment**. The processing time to deice/anti-ice aircraft for the same weather conditions and fluids varies by aircraft types. In terms of design, narrow-body aircraft are processed quicker than wide-body aircraft, and aircraft with center fuselage mounted engines, such as DC 10s and Boeing 727s, require additional processing time. In terms of fleet mix, airports with a high percentage of narrow-body aircraft and a low percentage of wide-body aircraft may need additional deicing pads to adequately maintain this particular fleet's departure demand. A balanced fleet mix may provide a means to increase a facility's deicing capacity by relating flow rates of common sized aircraft to specific deicing pads.

**(4) Heating Performance and Volume Capacity of Mobile Deicing Vehicles**. Additional deicing pads may result from users that operate mobile deicing vehicles with small tank capacities or vehicles that require extended periods of time to heat fluids after refilling (for example, times approaching 20 minutes). One option that may offset such increases is the availability of closeby refilling points.

**(5) Remote Deicing Facilities**. Depending on the airport, construction of a remote deicing facility may counter some of the above factors.

**b. Number of Deicing Facilities**. The estimated number of deicing pads plus other structural and operational needs of a deicing facility provide an approximate physical space requirement for siting the facility. Once the facility's overall physical size requirement is known, the search for suitable sites follows within the framework of safety and operational siting factors cited in this AC.

**(1) Multiple Deicing Facilities**. When the estimated number of deicing pads cannot be physically sited or operationally managed (such as under traditional poor weather conditions) at a single site, additional facilities are recommended.

**(2) Type of Facility User**. Airports serving a wide variety of scheduled service by regional or commuter air carriers and nonscheduled service by air taxi, general aviation aircraft, and airline charters may better meet their deicing/anti-icing needs by constructing a separate deicing facility for the group. If a single facility is identified for <u>all</u> airport users, additional physical space may be necessary to meet any specific needs for one of the groups, e.g., for facilities that store fluids; adequate space for storing appropriate deicing/anti-icing fluids for smaller aircraft.

**8. FACTORS AFFECTING FACILITY LOCATION AND SIZE**. The primary factor for siting deicing facilities is a taxiing time that begins with the start of the last step of the deicing/anti-icing treatment and ends with takeoff clearance, such that the holdover times of fluids are still in effect. The analysis should use slower taxiing speeds experienced under winter-contaminated conditions as well as other time-contributing factors specific to the airport. To assist in balancing holdover times and winter taxiing times from the facility to takeoff, SAE ARP 4737 and ISO 11076, current editions, provide for departure planning holdover time charts for various anti-icers, such as, type I, type IV. Other factors involved in locating facilities follow.

**a. Restrictions on Deicing/Anti-icing Fluids**. Restrictions on deicing fluid usage can impact the siting of facilities. Though for the same weather conditions non-newtonian fluids, such as, type II, type IV, provide longer holdover times as compared to type I, a newtonian fluids, they are restricted to aircraft with higher takeoff rotational speeds (e.g., 100 knots or as approved by airframe manufacturers). This restriction may necessitate siting a facility closer to the departure runway in order to serve restricted aircraft or to have separate facilities for the two groups. Also, facility siting may have to take into account airports that are located in very cold climates since type II fluids have a lower temperature application limit, e.g., -13° F (-25° C).

**b. Effects of Fluid Applicators**.

**(1) Mobile Deicing Vehicles**. Normally, the use of mobile deicing vehicles as compared to fixed fluid applicators increases the number of suitable sites for facilities by permitting closer construction to active runways. However, for certain airports, a close site may require considerable construction of new service roads and/or staging areas for such vehicles to serve the facility.

**(2) Fixed Fluid Applicators**. Use of fixed fluid applicators, such as a gantry, telescopic booms, etc., will limit the number of suitable sites due to height restrictions (for example, AC 150/5300-13, object clearing criteria). However, this type of applicator may be a means for airports to reduce vehicle traffic, escorting demands, or compensate for the lack of service roads and staging areas. If fixed fluid applicators are installed, each deicing pad is still required to have the outer maneuvering area for two mobile deicing vehicles.

**c. Fleet Mix**. The physical space required by deicing facilities depends to some degree on the fleet mix being served. For instance, airports serving a large variety of aircraft types and sizes may require facilities more flexible and complex than those airports serving predominantly one class of aircraft. The latter case is more conducive to standardizing the design requirements of a facility.

**d. Existing Taxiing Routes**. Before siting deicing facilities away from the terminal areas, the use of existing taxiways that minimize the taxiing time to the facility should first be evaluated, and more importantly, the subsequent taxiing time remaining between treatment and takeoff.

**e. Environmental Runoff Alternative**. The cost-effective environmental alternatives to control deicer runoff available to the airport may subsequently reduce the number of adequate sites for a deicing facility. For example, land-locked airports near large bodies of water may have to site a facility closer to existing sanitary sewers than departure runways.

**f. Integrating Airport Safety Programs**. It is recommended, when identifying deicing/anti-icing needs, that means to integrate airport safety programs with the operation of a deicing facility be found to maintain safety initiatives. For instance, the runway incursion program at busy airports may be maintained by widening service roads for bi-directional traffic or by designating additional staging areas instead of constructing separate roads. Other potentially affected safety programs include the airport's Emergency Plan and the Snow and Ice Control Plan. More than likely, there will be changes to the latter. For instance, previously non-cleared service roads to departure runways that are now required by deicing vehicles or authorized personnel in order to conduct post-treatment exterior checks may need reclassification to priority 1 snow clearing status.

**9. FLUID HANDLING REQUIREMENTS AT DEICING FACILITIES**.

**a. Storage Tank and Fluid Transfer System Designs**. Overheating, excessive mechanical shearing or contamination such as by corroded tanks may degrade the holdover characteristics of non-newtonian fluids. Non-newtonian fluids are type IIs, type IIIs, and types IVs. Newtonian fluids are type Is (see SAE ARP 4737, current edition, for fluid classifications). To protect the performance characteristics of these fluids from such degradation, storage tanks and fluid transfer systems installed at deicing facilities should be designed in accordance with the fluid manufacturer's recommendations. Fluid transfer systems shall be dedicated to the specific fluid being handled to prevent inadvertently mixing fluids of different types or different manufactures. Fluid manufacturers should provide the airport manager recommendations regarding compatible pumps, control valves, piping, and compatible storage tanks. Additionally, SAE ARP 4737, current edition, provides industry recommended practices for storage tank and transfer systems.

**b. Separate Storage Tank Capacity**. Deicing facilities using various types of deicing/anti-icing fluids will require more physical space to permit separate storage of fluids. Fluid manufacturers should always be consulted for storage tank requirements, maintenance, and precautions for currently used fluids and new products entering the market.

**c. Tanks, Fill Ports, and Discharge Points Labeling**. To avoid cross contamination of deicing fluids at a deicing facility, all tanks, fill ports, and discharge points shall be conspicuously labeled for the type of fluid handled, e.g., *SAE TYPE I AIRCRAFT DEICING FLUID, ISO TYPE II AIRCRAFT DEICING FLUID.*

**10. NIGHTTIME LIGHTING**. All facilities shall provide permanent nighttime lighting structures or have portable nighttime lighting systems available so that ground crews have the necessary illumination for deicing/anti-icing operations and pretakeoff inspections during night or low visibility conditions. One portable alternative is mobile deicing vehicles with modified lights that provide sufficient illumination for deicing/anti-icing treatments and pretakeoff inspections during night or low visibility. AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, provides general lighting recommendations common to apron related functions. As a precaution, height of lighting poles should be in accordance with AC 150/5300-13 object clearing criteria. Permanent nighttime lights should be aimed and shielded to avoid glare to pilots and ATCT's line-of-sight without reducing the illumination in critical areas.

**11. BYPASS TAXIING CAPABILITY**. To further maximize departure flows for all departing aircraft, potential sites should have the physical space so that deicing facilities have bypass taxiing capability. This feature permits the facility to receive aircraft that require treatment, while allowing other aircraft to continue unimpeded for departure. Figure 2-1 provides an example.

**12. MULTIPLE DEICING QUEUES**. Gains in deicing capacity at off-gate facilities are possible when deicing pads have individual entrance and exit queuing capabilities (for example, see figure 3-3). These features give ATCT greater flexibility to issue departure clearances without subjecting aircraft to a "first in/first-out" queuing situation. Such design features are recommended, if practicable, for off-gate facilities that experience extended periods of operations under continuous poor weather conditions.

**13. TOPOGRAPHY**. Topography is a key cost factor in constructing a deicing facility.

**a. Final Grades**. To reduce construction costs, facilities should be sited on relatively flat land where the natural terrain features conform to the final grades for the ultimate design of the deicing facility.

**b. Drainage Areas**. Sites with high water tables that require costly subdrainage and a runoff mitigation alternative should be avoided. The final site should readily lend itself to facility runoff mitigation at reasonable cost. AC 150/5320-5, *Airport Drainage*, provides design of airfield drainage system.

**14. UTILITIES**. Although subordinate to other siting factors, the airport manager should evaluate whether or not to extend electric power, telephone service, and sanitary or storm sewers to support an off-gate facility. For some situations, independent service installations or a separate runoff mitigation alternative at the site may be more cost-effective.

**15. THE AIRPORT LAYOUT PLAN (ALP) AND SITING AND SIZING FACILITIES**. Review of the airport's ALP provides information that simplifies the siting and sizing process. Some ALPs delineate planned land acquisition areas adjacent to airport property for airport development. Consequently, a revision can show such identified areas for a deicing facility. However, every effort should be made to avoid precluding the development of other types of airfield facilities approved to enhance future airport capacity. Any changes to the ALP should be considered carefully and all changes documented and submitted to the FAA for approval.

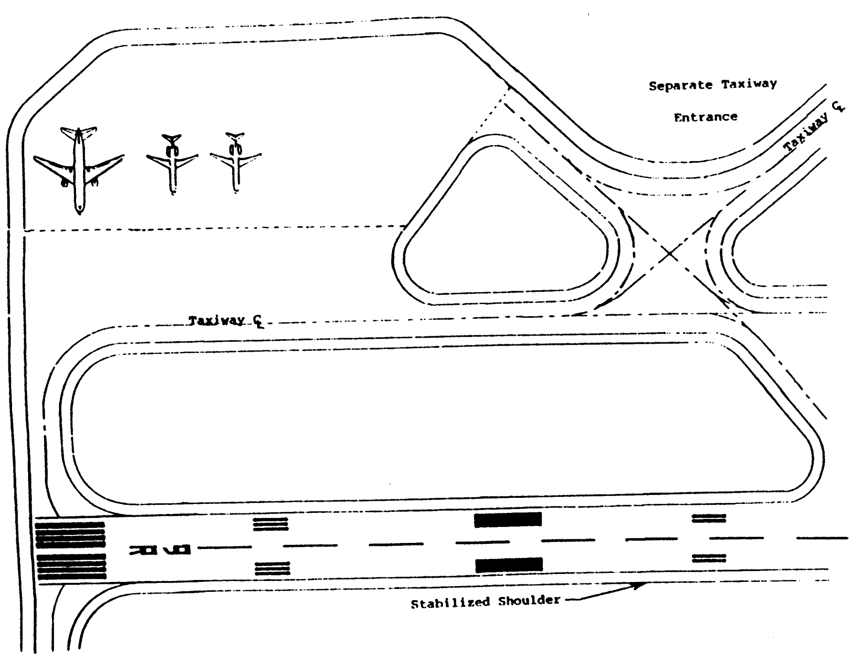


Figure 2-1. Separate taxiing entrance to an aircraft deicing facility

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## CHAPTER 4. AIRCRAFT ACCESS AND VEHICLE SERVICE ROADS

**22. AIRCRAFT ACCESS ROUTES**. Deicing facilities shall have some form of bypass taxiing capability to accept aircraft requiring treatment without restricting other aircraft access to active runways. Besides supporting departure demand for the anticipated weather conditions, this feature may offer an aircraft a return route for redeicing when it exceeds its holdover time. The merging of taxiing routes serving the facility with other taxiing routes should allow ATCT easy directional control to direct aircraft for deicing or clear the aircraft for departure.

**a. Holding Bays**. Some airports will not have the physical space for facilities to have a separate taxiway for bypass taxiing capability. One alternative to reducing potential bottlenecks is the expansion or construction of a holding bay. The size of the holding bay should allow aircraft the maneuverability to be deiced/anti-iced while permitting subsequent aircraft bypass taxiing capability.

**b. Design of Taxiing Access Routes for Facilities**. Access taxiing routes for facilities shall be designed in accordance with AC 150/5300-13, AC 150/5320-6, and AC 150/5320-12. Additionally, taxiing routes should:

**(1)** have a minimum of turns, taxiway intersections, and runway crossings.

**(2)** avoid areas that require repeated ATCT clearances.

**(3)** not create potential bottlenecks nor operational problems for landing aircraft.

**23. VEHICLE SERVICE ROADS**. Deicing facilities may require vehicle service roads or staging areas to operate more efficiently, to reduce the likelihood of runway incursions by deicing vehicles and ground service vehicles, or to operate the environmental alternative for managing deicing fluid runoff. In order not to compromise the emergency response times of aircraft rescue and firefighting vehicles when deicing vehicle traffic is heavy on a service road, pullover shoulders or similar provisions should be made.

**a. Operational Dependency**. Usually, centralized facilities depend less on service roads than remote facilities because of their closer proximity to the terminal apron areas. One possible means to further lessen the need for service roads at a centralized facility is the installation of deicing fluid storage tanks and transfer systems or fixed fluid applicators. Remote deicing facilities are recommended to have a service road when no other means, such as a nonactive taxiway, is available for mobile deicing vehicles and service vehicles to reach the site. This service road provides authorized personnel the access necessary to conduct outside the aircraft checks, pretakeoff contamination checks, and perform deicing/anti-icing treatment.

**b. Safety Dependency**. Reducing potential runway/taxiway incursions by deicing vehicles and ground service equipment is a safety objective. A service road is recommended when no other means is available to separate deicing vehicles and aircraft traffic from sharing a common taxiway route. For some airports, an extension to an existing service road or perimeter road is sufficient. Depending on the airport's safety programs, physical constraints, etc., service vehicles without the benefit of a vehicle service road may still need to be escorted on taxiway/runways.

**c. Environmental Dependency**. The environmental mitigation alternative needed to manage deicing fluid runoff may require a service road. For instance, a deicing facility with a detention basin may require an extension of a perimeter road for airport vehicles to reach the basin for monitoring and metering out permitted discharges. Another example where a deicing facility may need a service road is one whose underground storage tank or a concrete vault requires a hauling truck to siphon contaminants for proper disposal.

**d. Service Road Design**. Service roads should accommodate deicing vehicle widths and turning radii requirements. Vehicle dimensions and other characteristics related to service road design are found in current editions of SAE ARP 1447, *Aircraft Deicing/Anti-icing Self Propelled Vehicle*, *Functional Requirements*, SAE ARP 1971, *Large Deicing Equipment*, SAE ARP 4047, *Small Deicing Equipment*, and ISO 11077, *Aerospace - De-icing/anti-icing self propelled vehicles - Functional requirements*. If vehicles use remote staging areas, they should be located, to the extent practicable, such that service roads minimize runway crossings, repeated ATCT clearances, or airport escorting. Additionally, service roads should:

**(1)** have the handling capacity to permit the necessary number of deicing vehicles to transport a quantity of fluid that equals the facility's peak deicing fluid demand.

**(2)** have clearly defined circulation routes with the minimum of taxiway and runway crossings to reduce potential incursions. Service roads for airports operating under a SMGCS Plan may require vehicle stop signs, stop bars, etc., to be installed where they intersect an aircraft movement area operating under the Plan.

**(3)** be located so as not to create an aircraft hazard or impede emergency response times of aircraft rescue and firefighting vehicles.

**(4)** be bi-directional where vehicle traffic is heavy.

**(5)** avoid conflicts with future airport development.

**(6)** not create additional congestion and inconveniences to other users.

# CHAPTER 5. WATER QUALITY MITIGATION

**24. RUNOFF MITIGATING STRUCTURES**. Since deicing/anti-icing fluids are chemical products with environmental consequences, deicing facilities shall have runoff mitigating structures. The recommended structures are those that comprise a mitigating alternative that collects and retains runoff for proper disposal or recycling. In terms of structural best management practices (BMPs), this approach to "control the source" offers airport managers an effective and economical means to comply with storm water permitting requirements. Change 1 to AC 150/5320-15, *Management of Airport Industrial Waste*, provides additional BMPs to mitigate various types of pollutants from entering storm water runoff conveyances.

**a. Treatment Advantages**. The approach to "control the source" offers two treatment advantages. First, it lessens the difficulty of dealing with the facility's deicer runoff by isolating it from airfield storm sewers or from terminal areas that do not divert seasonal flows of glycols. Second, deicing facilities enhance the feasibility of recycling glycols by collecting higher glycol concentrations, as compared to drainage systems where glycols are further diluted with other runoff and precipitation.

**b. Treatment Parameters**. Of the discharge parameters the alternative needs to mitigate, biochemical oxygen demand (BOD) and toxicity are the primary runoff effects requiring control. The additives in fluids may have an effect on the overall biodegradability. Depending on the type of discharge permit, the alternative would need to monitor specific items, generally based on $BOD_5$, chemical oxygen demand (COD), total organic carbon (TOC), total suspended solids (TSS), oil/grease, pH, and flow rate limits.

**25. MITIGATION ALTERNATIVES**. The mitigation alternative should allow users of the deicing facility continued use of deicing fluids within the framework of Federal, state, and local storm water runoff regulations (discharge permits). It is strongly recommended that the proposed alternative be reviewed by the Federal, state, or local environmental authority having jurisdiction to verify its effectiveness to place the deicing facility in regulatory compliance. Prior to final selection, all alternatives should be evaluated on a life cycle cost basis to avoid an accepted long term alternative with a short useful life, for an example see paragraph 26, PUBLICLY OWNED TREATMENT WORKS (POTW). Additionally, it should reflect the best alternative afforded by the facility's site and integration with the airport master drainage plan. A few alternatives are:

**a.** off-airport biological treatment of facility runoff at POTWs by way of a sanitary sewer. See paragraph 26, Publicly Owned Treatment Works, for additional guidance.

**b.** on-airport detention basin with pump station for discharging metered runoff to receiving waters by an airport storm sewer. See paragraph 27, Detention Basins, for additional guidance.

**c.** on-airport underground storage tanks (UST) or concrete vaults for detention of runoff for hauling tankers to siphon for proper disposal. For airports lacking the physical space for detention ponds, USTs near the facility is an alternative. See paragraph 28, Underground Storage Tanks, for additional guidance.

**d.** on-airport recycling system. See paragraph 29, Recycling Glycol Fluids, for additional guidance.

**e.** diversion boxes for diverting seasonal glycol runoff to a specific location, such as a detention basin.

Depending on the site and storm water permitting requirements, one of the above alternatives and/or other technologies working in tandem should provide the airport manager with an effective alternative acceptable to Federal, state, and local environmental authorities.

**26. PUBLICLY OWNED TREATMENT WORKS (POTW)**. Off-airport biological treatment of facility runoff at POTWs is a proven mitigation alternative. This alternative normally requires the airport manager to monitor flow volumes and pretreat glycol contaminated storm water to protect the receiving POTW facility. Areas of probable pretreatment are high $BOD_5$, COD, TOC, TSS, pH, and oil/grease. Of these, treatment of glycol BOD loads is of primary concern since some data measure an impact load of approximately 3,000 times that of raw human sewage. To protect POTW, the United States Environmental Protection Agency (USEPA) developed a national pretreatment strategy (1977) under the Clean Water Act. The regulations were published as 40 CFR Part 403. Airports in smaller communities considering this alternative should not only evaluate the POTW's current capacity but whether it can accept both future load demands from the airport and a growing community.

**27. DETENTION BASINS**. For airports with available physical space, an economical alternative to treating "first flush" runoff from deicing facilities is by a single or series of detention basins. The state or local authority having jurisdiction generally sets construction and design standards. Impermeable liners to protect the groundwater and/or monitoring wells to detect breached liners are likely to be required.

**a. Sizing**. Biodegradability rate, which varies by glycol types, is a primary factor for determining basin capacity. Basin capacity can be reduced by taking into account the slower microbial activity during the winter season and the greater quantity of available oxygen in colder water. Detention of ethylene glycol, which degrades quicker than propylene glycol, permits earlier metered discharges and, thus, reduced basin capacity.

**b. Mechanical Aeration**. The quick consumption of available oxygen levels within basins by glycols can lead to anaerobic conditions (lack of oxygen). This condition leads to potential septic conditions (undesirable odors) due to the adverse impacts to bacterial generation necessary for glycol degradation. A recommended corrective action is to install a mechanically aerated system to replenish oxygen levels. This supplemental acceleration of biodegradation and thus, earlier discharging of glycols, further reduces a basin's capacity. The installed system should maintain dissolved oxygen levels at the level that places the alternative in environmental compliance. For some basins, pump stations and force mains may be required if the discharge cannot reach the desired outfall locations.

**c. Wildlife Management**. AC 150/5320-15 provides recommended configurations from a wildlife standpoint.

**d. Other Features**. Additional design features may be necessary if runway deicers containing urea or other effluents are collected within a basin that contains nutrients for plant growth. For instance, the growth of algae blooms under the right conditions may be for some environmental authorities regarded as suspended solids. Their inclusion to the TSS discharge limit may cause this alternative to exceed permitted levels.

**28. UNDERGROUND STORAGE TANKS (UST)**. UST systems that collect ethylene glycol deicing fluids are regulated under the USEPA UST regulations, i.e., 40 CFR, Parts 280 and 281. Though other types of glycols are available which may not be regulated, this alternative has the potential to collect a regulated substance such as aviation fuel. Because of this potential and future use of ethylene glycol based fluids by tenants, it is recommended that this alternative be designed in accordance with applicable USEPA and state UST regulations. For facilities used on a yearly basis, this alternative may collect regulated substances when the deicing pads are used for washing the exterior of aircraft. If a UST is the final collection point, a rigid pad with catch basin may be required for hauling tankers.

**29. RECYCLING GLYCOL FLUIDS**. Depending on the content nature of the runoff and economics, improved technologies are available for recycling spent glycol fluids collected at concentrations of 5 percent and, under certain conditions, even lower percentages. In terms of recycling fluid types that offer longer holdover times as compared to type I fluids, the fluid types are normally more demanding to recycle because of special polymers. This however, is resolved simply by the addition of an extra processing step, thus making recycling an economical consideration. Recycling provides airport management with two valued resources. The first resource is recycled glycol and the second resource is water. Besides recouping some of the chemical cost for glycol and the utility cost for water, other recycling benefits may be reduced sludge disposal costs incurred by other mitigation alternatives and less physical space for equipment.

**a. Recycled Glycol Fluids**. Recycling glycol may offer airport management lower disposal cost of effluent through the resale of recovered product to fluid manufacturers or to other secondary markets. Prior to using recycled glycols as the primary aircraft deicer/anti-icer fluid, recertification in accordance with established industry standards is necessary, for example SAE, ISO. In regard to pavements, recycled glycol fluids may be reused on the airfield pavements if they meet the appropriate glycol-based runway fluid specifications in AC 150/5200-30A, *Airport Winter Safety and Operations*.

**b. Recycled Water.** The limited availability and high costs of water for some airports may make recycling a cost-effective runoff mitigation alternative. Airport management can commit recovered water, if permitted, to irrigate airport landscapes, wash airport/aircraft equipment, or for other non-potable water use.